FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION – 2025

FOR RECRUITMENT TO POSTS IN BS-17

UNDER THE FEDERAL GOVERNMENT

Roll Number

Chemistry Paper-II

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
PART-I(MCQS): MAXIMUM 30 MINUTES	**PART-II MAXIMUM MARKS = 80**

NOTE:

(i) First attempted **Part-I (MCQS)** on the separate **OMR Answer Book** which shall be taken back after 30 minutes**.**

(ii) Overwriting/cutting of the **options/answers** will not be given credit.

(iii) There is no **negative marking**. All **MCQs** must be attempted.

PART-I (MCQs) (COMPULSORY)

Q.1 **(i)** Select the best option/answer and fill in the appropriate Box on the **OMR Answer Sheet. (20 × 1 = 20)**
(ii) Answers given anywhere else, other than OMR Answer Sheet, will not be considered.

1. Which of the following is the primary site for the digestion of carbohydrates?
(A) Stomach
(B) Mouth
(C) Small intestine
(D) None of these

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2. In glycolysis, the enzyme hexokinase catalyzes the conversion of:
(A) Glucose to glucose-6-phosphate
(B) Pyruvate to lactate
(C) Fructose-6-phosphate to fructose-1,6-bisphosphate
(D) None of these

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3. Which of the following is a common byproduct of the cement manufacturing process?
(A) Sulfur dioxide (SO_2)
(B) Nitrogen oxides (NO_x)
(C) Both (A) and (B)
(D) None of these

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4. The raw materials for glass manufacturing typically include:
(A) Limestone and sand
(B) Sand, soda ash, and lime
(C) Clay and sodium hydroxide
(D) None of these

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5. Starch is composed of:
(A) Amylose and amylopectin
(B) Glycogen and amylopectin
(C) Amylopectin and cellulose
(D) None of these

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6. An allosteric enzyme:
(A) Follows Michaelis-Menten kinetics
(B) Is regulated by molecules that bind to a site other than the active site
(C) Is always inhibited by competitive inhibitors
(D) None of these

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7. What type of fragmentation occurs in mass spectrometry?
(A) Homolytic cleavage
(B) Heterolytic cleavage
(C) Both (A) and (B)
(D) None of these

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8. In IR spectroscopy, the fingerprint region is found in the range:
(A) 4000–2500 cm^{-1}
(B) 2500–1500 cm^{-1}
(C) 1500–600 cm^{-1}
(D) None of these

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9. Which of the following is stereospecific?
(A) Free radical substitution
(B) SN2 reaction
(C) E2 reaction with anti-periplanar elimination
(D) None of these

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10. A molecule is chiral if:
(A) It has at least one plane of symmetry
(B) It has a chiral center and is non-superimposable on its mirror image
(C) It rotates polarized light to the left
(D) None of these

11. Which reaction is most likely to occur with a bulky base like tert-butoxide?
(A) SN1
(B) SN2
(C) E2
(D) None of these

12. What is the major product when ethyl acetate is hydrolyzed under acidic conditions?
(A) Acetic acid and ethanol
(B) Acetaldehyde and ethanol
(C) Acetone and ethanol
(D) None of these

13. Which reaction involves the conversion of aldehydes into alcohols?
(A) Oxidation
(B) Reduction
(C) Hydrolysis
(D) None of these

14. Which compound will give a silver mirror test with Tollens' reagent?
(A) Propanone
(B) Ethanal
(C) Benzophenone
(D) None of these

15. The resonance energy of benzene is approximately:
(A) 150 kJ/mol
(B) 200 kJ/mol
(C) 250 kJ/mol
(D) None of these

16. Which of the following compounds are aromatic?
(A) A, B, and D
(B) A, C, and D
(C) A and D
(D) None of these

17. What is the main product when nitrobenzene reacts with chlorine in the presence of $AlCl_3$?
(A) Ortho-chloronitrobenzene
(B) Meta-chloronitrobenzene
(C) Chlorobenzene
(D) None of these

18. Which type of substitution occurs predominantly in benzene?
(A) Nucleophilic substitution
(B) Electrophilic substitution
(C) Free radical substitution
(D) None of these

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19. What is the main product when 1-butyne reacts with excess HBr?
(A) 1-Bromobutene
(B) 1-Bromobutane
(C) 2,2-Dibromobutane
(D) None of these

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20. Which of the following has the highest dipole moment?
(A) CO_2
(B) H_2O
(C) CCl_4
(D) None of these

PART-II

NOTE:

(i) Part-II is to be attempted on the separate **Answer Book.**
(ii) Attempt **ONLY FOUR** questions from **PART-II. ALL** questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the question will not be considered.
(vii) Use of Calculator is allowed.

Q.2. **(a)** Elaborate with examples that how resonance, hyperconjugation and inductive effect, can contribute towards the stability of carbocations. **(10)**

(b) How 'dipole moment' can be measured? Indicate, among the following molecules which does not have dipole moment and why? **(10)**

i. CCl4 **ii. BF3** **iii. CHCl3** **iv. NH3**

Q.3. **(a)** How does the reaction mechanism work for the electrophilic addition of bromine to ethene? Explain the intermediate (s). **(10)**

(b) Describe the IUPAC rules for naming alkenes and alkynes with appropriate examples. **(10)**

Q.4. **(a)** Categorize benzene substituents, into activating and deactivating groups. Explain their influence on ortho, para and meta orientation of incoming groups in electrophilic substitution reactions. **(12)**

	(b)	How did Kekulé propose the benzene structure, and what evidence supported his model?	**(8)**
Q.5.	**(a)**	Compare the reactivity of acid halides, anhydrides, esters, and amides toward nucleophilic substitution. What kind of products do you expect when these react with Grignard reagent (RMgX)?	**(10)**
	(b)	Explain the reaction mechanism of Williamson synthesis to prepare ethers.	**(5)**
	(c)	Discuss the acidic nature of phenols. Why picric acid **($C_6H_3N_3O_7$)** is considered strong acid?	**(5)**
Q.6.	**(a)**	Given below is the structure of (1R, 2S, 5R) menthol. Draw the structures of all possible stereoisomers of menthol.	**(8)**
	(b)	How does Hofmann's rule differ from Zaitsev's rule? Explain each with suitable example.	**(6)**
	(c)	Describe the main components of a UV/Visible spectrophotometer and their functions.	**(6)**
Q.7.	**(a)**	Write a comprehensive note on primary, secondary, tertiary, and quaternary structures of proteins.	**(10)**
	(b)	Write a note on enzyme catalysis and enzyme inhibition.	**(10)**
Q.8.	**(a)**	Outline the steps of the Krebs cycle, and explain its role in cellular respiration.	
	(b)	Describe the environmental impact of the manufacturing industry of sugar, cement, glass, paper and fertilizers. How these industries can address environmental concerns?	